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Groundwater Quality Analysis of various Physicochemical Parameter

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Abstract: An effort has been made to collect the Wardha municipal groundwater quality for drinking purposes. Eight samples of groundwater were taken for this study. The American Public Health Association (APHA, 1995) has specified standard methodologies for groundwater sampling. To determine the water quality index, eight water quality factors pH, chloride, fluoride, calcium, magnesium, alkalinity, hardness, and nitrate. The Bureau of Indian Standards (BIS, 2012) has been considered for determining whether groundwater is fit for drinking and when calculating WQI. According to this survey, 76% of the area falls into the excellent, very good, and good category, while 24% of the area falls into the poor, extremely poor, and unfit category as per the WQI classification. The given result's expected accuracy is around 97.05%, which reflects the effectiveness of the used methods. Anthropogenic activities have an impact on the research area's groundwater quality. The current study is beneficial for effective planning and management of the water resources that are accessible for drinking.

Keywords: Groundwater quality, Physicochemical Parameter, quality metrics, factor analysis, statistical analysis, and sample gathering.

I. INTRODUCTION

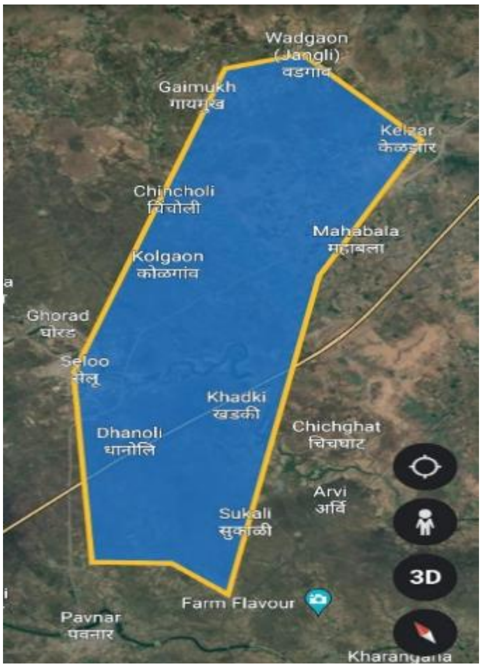
Water covers 71% of the surface of the planet, with only 2.5% of it being freshwater and 96.5% of it being ocean water. In that, glaciers and ice caps hold 68% of the freshwater, while groundwater holds 30%. This demonstrates that groundwater meets most of our demands for water. Therefore, groundwater is essential to human life for several reasons. For economic growth and the reliable supply of drinkable water in both urban and rural settings, ground water is a very significant natural resource. Today, one of the most important issues on the planet is groundwater contamination. Groundwater quantity and quality are impacted by urbanization, industry, and agricultural activities.

The hazard of water contamination to human health, economic growth, and social well-being. The quality of groundwater is now understood to be almost as important as the quantity in recent years. The current understanding of the scarce resources and conflicting needs is apparent. This has made it urgent to use cutting-edge methods to monitor and safeguard the quality of groundwater.

II. LOCATION OF STUDY

The western Indian state of Maharashtra contains the Wardha District. The division of Nagpur includes this district. The district's administrative center is in the city of Wardha. The district's principal cities include Hinganghat, Pulgaon, Arvi, and Wardha. There were 1,300,774 people living in the district as of 2011, and 26.28% of them were urban.

We chose eight of the communities or villages in the Wardha district that are impacted by industrial regions.



III. SAMPLING AND TESTING

During the month of November 2022, 16 samples were taken from 8 bore wells and 8 wells at the chosen places nearby, the samples were taken in 1-liter polyethylene cans for the bacteriological assays and in pre-sterilized plastic bottles for the sample collection. Chemical parameters such as pH, Electrical Conductivity, Turbidity, Chloride, Alkalinity, Dissolved Oxygen, Iron, Fluoride, COD and Calcium were examined on the samples.

IV. GROUND WATER QUALITY PARAMETERS

The samples taken from the chosen site were examined for the following indicators of groundwater quality.

A. pH

The pH of water indicates how acidic or basic it is. The range is 0 to 14, with 7 representing neutrality. Acidity is indicated by a pH of less than 7, whereas baseness is indicated by a pH of higher than 7. PH is a measurement of the proportion of free hydrogen and hydroxyl ions in water. Since chemicals in the water may change pH, pH is a key sign that the chemical composition of the water is changing.

B. Electrical Conductivity

Electric conductivity is a measurement of how easily an electric current flows through a material. Additionally, the higher the current density for a given applied potential difference, the better the electrical conductivity of the material.

Electrical conductivity may be defined as a substance's capacity to carry electricity in plain English. Additionally, we can consider that a material's electrical conductivity or conductance is crucial since some substances must conduct electricity while others do not.

For instance, the wire conductors must make it as simple as possible for electricity to flow. While other minerals are necessary, like in the case of a resistor, to limit the passage of electricity.

However, certain other materials must not conduct electricity as well.

C. Turbidity

The relative transparency of a liquid is measured by its turbidity. When light is shone through a water sample, it expresses the quantity of light that is dispersed by the materials in the water as an optical property of water. The turbidity increases with the magnitude of dispersed light. Clay, silt, finely split inorganic and organic materials, algae, soluble colored organic compounds, plankton, and other microscopic creatures are among the substances that make water turbid.

Excessive turbidity, or cloudiness, in drinking water is unsightly and could be dangerous for your health. Therefore, determining the turbidity of water is crucial.

D. Chloride

Chlorides gives tap water its salty flavor.

Agricultural crops and iron pipelines are both harmed by high chloride concentration. When choosing supplies for human consumption, it's crucial to examine if brackish water will be utilized for household purposes in order to choose the right desalination device. Utilizing a silver nitrate solution titration, chloride is determined volumetrically. The measurement is in mg/L.

E. Alkalinity

It measures an object's ability to neutralize acids. Although weak or strong bases may also be a factor, weak acid salts are the main cause. Alkalinity is a crucial factor in corrosion management and in calculating the amount of soda ash needed for the precipitation technique of softening water. By volumetric titration with 0.02N H_2SO_4 or HCl, alkalinity is determined. $CaCO_3$ is used to represent it in terms of overall alkalinity.

F. Dissolved Oxygen

DO is thought to be a key marker of how well-trained an aquatic resource is to support aquatic life. Levels of DO are tested for the National Aquatic Resource Surveys (NARS) using a calibrated water quality probe meter, generally in combination with values for temperature and pH. Waterways with DO levels below 3 mg/L are generally considered hypoxic and are largely dead, while each species has a particular DO tolerance range. Hypoxic waters are those with levels under 1 mg/L.

G. Iron

One of the most crucial aspects of the quality of groundwater is iron. The bitter and astringent taste of water is caused by an excessive quantity of iron. Furthermore, contributes to bacterial growth in service mains and scaling of boilers.

The Bureau of Indian Standards states that 0.3mg/liter of iron is the ideal level for drinking water.

H. Fluoride

Fluoride can be found in nature as fluorsoar (fluorite), triphite, phosphate, and rock phosphate crystals. Fluorite concentration is influenced by two factors: the local environment and the presence of auxiliary minerals in the assembly of rock minerals in flowing. According to is, the allowable limit for fluorite is between 1 and 1.5 mg/l: 10500-2012.

I. COD

The chemical oxygen demand (COD), a useful indicator of how much oxygen may be used by processes in a measured solution, is used in environmental chemistry. It is frequently stated as the mass of oxygen used over the volume of the solution, or milligrams per liter (mg/L), in SI units. It is simple to determine the concentration of organics in water using a COD test. Quantifying the quantity of oxidizable contaminants present in surface water (such as lakes and rivers) or wastewater is the most typical application of COD. Similar to biochemical oxygen demand (BOD), COD provides a measure to assess the impact an effluent will have on the receiving body, making it valuable in the context of water quality.

J. Calcium

It is measured by sophisticated metric titration utilizing a standard ETDA solution and Patton and Reeder's indicator under more than 120 pH values. In order to produce these conditions, a predetermined quantity of 4N sodium hydroxide is applied. By comparing the volume of the titer (EDTA solution) to the volume of the sample, one may ascertain the sample's calcium concentration.

V. RESULT AND DISCUSSION

The test results for the analysed samples are shown in table II. On comparing the obtained results with the IS 10500-2012, it was seen that iron, turbidity and values of most of the samples are greater than its desirable limits. Many of the samples also shows the presence of coliforms in the bacteriological examination thus making it unfit for drinking.

DESIRABLE LIMITS ACCORDING TO IS 10500:2012 TABLE -I

CHARACTERISTICS	UNIT	DESIRABLE LIMITS
pH		6.5-8.5
Electrical Conductivity	cm	1-5
Turbidity	NTU	1
Chloride	mg/l	250-600
Alkalinity	mg/l	200-600
Dissolved Oxygen	mg/l	4-6
Iron	mg/l	0.3
Fluoride	mg/l	1-1.5
COD	Mg/l	250
Calcium	mg/l	75-200

VI. CONCLUSION

1. pH values of water samples were found within Permissible limit.
2. All the samples showed Electrical conductivity under the permissible limit.
3. Turbidity is an important parameter to be kept below 5 to 10 except 4] -(MAHABALA) and 5]-(KANHAPUR) sample.
4. Permissible limit of chloride content in water is 250mg/lit. all the sample shows chloride content in permissible limit.
5. Dissolved oxygen is the most important parameter in water sample, more the dissolved oxygen more the freshness of water. Maximum limit of dissolved oxygen is not defined but minimum permissible limit is taken as 6.5-8mg/lit.
   All water sample satisfy the limit of dissolved oxygen in water.

TABLE -II

Sr. No.	Village Name	Water sample	pH	E. C.	Turbidity	Chloride	D.O.	Iron	Fluoride	Calcium
1.	Kelzar	Domestic **S1**	6.81	0.48	4.1	0.8	6.5	0.22	0.44	127.0
		Agricultural **S2**	6.7	0.53	1.2	1.2	5.9	0.14	0.38	104.0
2.	Wadgoan	Domestic **S1**	7.07	0.35	1.1	0.5	6	0.12	0.32	101.0
		Agricultural **S2**	6.65	0.47	6.2	1.2	6.1	0.12	0.26	69.0
3.	Jungad	Domestic **S1**	6.88	0.32	8.9	0.9	5.9	0.12	0.26	64.1
		Agricultural **S2**	7.03	0.33	9.9	1	7.3	0.1	0.28	79.4
4.	Seloo	Domestic **S1**	6.55	1.08	10.0	2.3	6.6	0.22	0.86	228.0
		Agricultural **S2**	6.66	1.01	11.2	3.5	7.6	0.24	0.84	221.0
5.	Mahabala	Domestic **S1**	6.83	0.65	10.6	1.9	6.4	0.19	0.72	176.0
		Agricultural **S2**	6.88	0.72	11	2.6	6.5	0.21	0.66	140.0
6.	Kanhapur	Domestic **S1**	6.75	1.37	5.4	3.3	7.2	0.28	0.88	318.0
		Agricultural **S2**	7.16	0.82	6.6	3.6	6.3	0.19	0.72	196.0
7.	Morchapur	Domestic **S1**	6.85	1.02	8.6	3.1	5.8	0.16	0.52	168.0
		Agricultural **S2**	6.65	0.66	6.4	2.7	6	0.25	0.74	240.0
8.	Wahitpur	Domestic **S1**	6.67	1.28	7	2.5	5.5	0.26	0.90	320.0
		Agricultural **S2**	7.09	0.7	5.4	1.8	4.8	0.17	0.50	166.0

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